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SCIENCE FAIR MANUAL

For Use In The

North Carolina

Science Fairs

Charles Hardin, South Mecklenburg High School, Charlotte Observer Science Fair First Prize, Senior Physical Division

N.C University of North Carolina, Chapel Hill. Institute of Natural Science

SCIENCE FAIR MANUAL

For Use In The Science Fair Program In The State of North Carolina

PURPOSES

To acquaint teachers and students with the Science Fair Program

To help teachers and students in the preparation of projects for use in Science Fairs

To offer suggestions concerning the promotion of local fairs, the judging of exhibits, the awarding of prizes, and the handling of publicity

Carl Abramson, South Mecklenburg High School, Charlotte Observer Science Fair First Prize, Senior Biological Division

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James Sylivant, Stedman High, State Science Fair
First Place Winner of Carolina Power & Light Company Youth Conference on the Atom awards program

WHAT IS A SCIENCE FAIR?

A Science Fair is an exhibition of scientific work and scientific projects prepared and presented by junior and senior high school students under the direction of their teachers and with the help and assistance of other interested people.

Essentially a science fair is a collection of exhibits, each of which is designed to show a scientific principle, a laboratory procedure, or an industrial development. A science fair provides an opportunity for students with imagination and initiative to display their ideas, research, and handiwork, in science and mathematics.

Science fairs vary in magnitude, content, and scope. *Classroom fairs* comprise a basic step in science fair activity and supplement the classroom science instruction. *Local science fairs* are held for one school or for a school system. *District science fairs* are made up of exhibits from within a given geographic area. *State science fairs* bring together exhibits from over an entire state. The culmination of the science fair program in the United States is the *National Science Fair,* which is organized and administered by Science Service, of Washington, D. C.

A science fair is not a substitute for sound, fundamental instruction in science. Rather it supplements the formal instructional program by offering the student and teacher the opportunity to use to its fullest extent the advantages of the project method of instruction and learning. It introduces the student to the advantages of individual endeavor and may give him his first contact with scientific research.

AIMS AND PURPOSES OF THE SCIENCE FAIR PROGRAM

To help discover the boys and girls who may become mature scientists and to help them prepare for careers in pure or applied science or mathematics, or in the related fields such as engineering, medicine, nursing.

To help interest all students in science, whether they are planning for a career in science or simply studying science as a hobby or for their cultural development.

To increase the number of scientifically trained personnel.

To provide education in science for the community by interesting the public in general in science and science teaching.

BENEFITS OF THE SCIENCE FAIR PROGRAM

The greatest benefit of a science fair program is gained by the student who prepares and enters an exhibit. During the course of his project work he has educational experiences that are of lasting importance and benefit: he learns how to recognize and solve problems, he does research, he acquires an appreciation of science and its applications, he becomes acquainted with and learns to utilize human and material resources, he developes confidence in himself, he becomes acquainted with basic educational disciplines, he uses exhibits as a means of communication, he shares his knowledge and experience with others, and he is in a position to evaluate himself and decide what studies he should follow and what career he should choose.

The teacher can use the science fair program as a valuable supplement to the regular class instruction. The students become acquainted with a much wider and diverse set of visual training aids and equipment than is possible in routine laboratory instruction. It is a means of adding interest and zest to the study of science. It serves to attract the interest of students not formally enrolled in science classes. Local fairs help link the parents to the classroom instruction. Science fairs afford an opportunity for the community as a whole to become interested in science and science teaching. Because of this interest scientifically trained persons and others interested in science make themselves available to help in the science program of the local schools.

THE SCIENCE FAIR PROGRAM IN NORTH CAROLINA

The science fair program in North Carolina is sponsored by the NORTH CAROLINA ACADEMY OF SCIENCE. This is an organization of scientists, mathematicians, and other interested people, in our North Carolina colleges and universities, in industry, in private laboratories, and in government laboratories. The Academy has played an outstanding part in the development of science in North Carolina.

In addition to the North Carolina Academy of Science a number of other organizations, companies, commercial laboratories, and several newspapers help sponsor with their interest and financial support. A list of the sponsors from the previous year is included in the *annual brochure* describing the science fair program. This brochure is prepared and issued by the North Carolina Academy of Science.

The North Carolina Academy directly sponsors the seven district fairs, the state fair, and the Charlotte fairs. These districts, whose geographical boundaries are shown on the annual brochure, correspond essentially to the present districts (from change in 1959) used by the North Carolina Educational Association. The various high schools may send students to their district fairs in accordance with the rules given in this Handbook and in the brochure. From each district fair five winners from the Senior Biological Division and five winners from the Senior Physical Sciences Division may enter the state fair. The first place winners at the State Fair in the Biological and Physical Sciences Division are given an expense-paid trip to the National Fair. Locations and dates of the district and state fair are given in the current science fair brochure.

A State Director of Science Fairs handles the general correspondence and the routine business concerned with the science fair program. *The address of the current director is given in the brochure.*

While the North Carolina Academy of Science does not sponsor fairs below the district level, it stands ready at all times to help local and school fairs in every way possible.

THE ORGANIZATION AND EXECUTION OF A SCIENCE FAIR

The idea of a science fair is usually initiated by a core of interested people, usually teachers, school officials, or the students in a science club. The first step is to obtain permission to hold a fair from the school principal, superintendent, board of education, or whatever person or unit may be in charge of the schools to be included in the fair. Once permission has been obtained, the sponsor, or sponsoring group, should determine the following:

1. *How large will the fair be?* Will it be limited to a single class, a school, or the schools in a given territory? Can all students who so wish enter or will individual classes and schools be limited as to the number of participants?
2. *Where and when will it be held?* How much space will be required? Does the space selected have proper facilities—electric current, possibly gas and water, etc? The space selected may be a laboratory, the school gymnasium, a recreation hall, a community building, or an armory. If a public building is used, proper police and fire protection has to be considered. Is the space selected accessible to the public and can the exhibits be observed by the public with a minimum of confusion?
3. *Which school grades will participate in the fair?*
4. *Who will judge the exhibits?* A discussion of judging is given in another section of this manual.
5. *What awards will be made?* A section on prizes and awards is given elsewhere in this manual.

Arriving at the proper answers to some of the above may best be worked out in the case of larger fairs by the appointment of special committees.

It should be decided very early whether or not prizes and awards should be given. If monetary awards are to be made or if awards requiring the expenditure of money are decided on, then the question arises as to how the proper financial support is to be obtained. This ties in with the possible need of money for other aspects of the fair—the obtaining of material for the construction of exhibits, decorations for the exhibit area, signs, etc. This leads into the question of sponsors which will be discussed in the next paragraph. Suggestions concerning prizes and awards are given in another section of the manual.

It is well to obtain as many sponsors and sponsoring agencies as possible. These sponsors can serve several useful purposes. They may contribute funds for prizes or purchase of material. They may contribute materials for the construction of exhibits, the prepara-

tion of signs, etc. Local newspapers, radio stations, and TV stations can help greatly with the publicity. Technical people may help with the construction of exhibits. Scientifically trained people—doctors, engineers, or laboratory personnel—can contribute to the development of the projects through talks with the individual students or through meetings with classes as a whole or with science clubs. Of course the main sponsor may be the science club at a school or the science clubs in the given territory. The names of all sponsors and sponsoring agencies should be listed in the fair program and given as much publicity as possible through the local press.

In order to carry out properly the purposes of a science fair proper publicity must be obtained. A publicity committee should handle this phase of the work. If possible have a member of the local press or the member of the staff of a local radio station on the publicity committee.

Students should be included as far as possible on all committees. After all, the fair is presented by them and they are the ones who should get the most out of it. Many students like to do committee work and they can be exceedingly valuable committee members.

The role of the individual teacher in motivating students to prepare exhibits and in helping them with their projects is discussed in another section of this Manual. Included in that section are the titles of some of the publications that the teacher may find useful in helping the students in the selection and preparation of their exhibits.

Summarizing, then, for a school or local fair, there should be a director and a steering committee. Other committees may include the following:

1. *Operations Committee.* This committee would have charge of preparing the exhibit area for the fair, supervising the setting up and removal of exhibits, handling of parking problems, handing out of programs, handling of ushers, supervising the handling of spectators, etc.
2. *Committee on Prizes and Awards.* This committee would have charge of obtaining the medals, ribbons, or other awards and the preparation of the certificates of participation. It would also have charge of presenting the awards.
3. *Judges Committee.* This committee would be responsible for obtaining the judges and seeing that they are properly orientated in their duties. They would have charge of furnishing the judges with proper information concerning the exhibits and with proper material—clip boards, judging sheets, etc. for use in the judging.

4. *Program Committee.* This committee will have charge of preparing the science fair program. This program should include the name, grade, and school of each exhibitor and of course the title of the exhibit. Exhibits should be arranged according to categories—junior biological exhibits, senior earth science exhibits, etc. The program may include paid advertisements or it may simply include the name of the individual or organization financially sponsoring it. Include the names of all sponsors and the names of all committee members. If the science fair is sponsored by a science club or several science clubs, be sure to include the names of the various club officers.

5. *Publicity Committee.* The duties of this committee are obvious. Information should go to all local newspapers, and radio and TV stations. If possible have someone appear from time to time on the radio or TV program. Get the information out early in the program and keep giving it out. See that the papers have photographers to take pictures at the fair.

6. *Sponsors Committee.* It is difficult to outline specific duties for this committee. It should seek sponsors for the various functions outlined earlier in this section of the Manual. It might keep a list of those persons who may be willing to give individual help to students in the preparation of their exhibits. The committee should learn the financial needs of the fair and try to obtain the necessary money with the minimum of solicitation and irritation to contributors.

Such questions as the territory to be included in the fair, the limitation on the number of exhibitors, the categories of exhibits, the selection of the exhibit area, and the date of the fair, can best be handled by the steering committee. These are all questions that should be answered early in the program.

After the fair is over, there should be a critique at which time various aspects of the fair are discussed while the fair is still fresh in the minds of those associated with it. Student participation can be an important phase of the critique. The discussion should give careful attention as to how the fair program can be strengthened in preparation for another year.

In many respects the sections of this Manual that deal with *Judging, Prizes and Awards, Rules and Regulations, Organization of the Science Fair Program in North Carolina, Suggestions for Teachers,* and *Pointers to Student Exhibitors* are a part of this section.

RULES AND REGULATIONS FOR EXHIBITORS

The North Carolina State Science Fair and the various District Fairs have well-defined rules patterned after the rules applicable to the National Science Fair.

While science fairs may establish their own rules, in general it is well to adhere to the rules of the district fairs and the state fair. Classroom fairs can probably best operate with a minimum of rules.

The following rules apply to district and state fairs. It is noted that the district fairs include both a junior and senior division whereas the state fair includes only a senior division. Only two categories apply in the district and state fairs: physical sciences and biological sciences.

JUNIOR DIVISION. (7th, 8th, and 9th grades)

1. Projects may be exhibited by one student or jointly by two or three students. Only one exhibit can be entered by a student or a team of students.
2. Junior projects are not eligible for competition in the state fair.

SENIOR DIVISION. (10th, 11th, and 12th grades)

1. Projects may be presented by only one student. Students are limited to one entry.
2. Senior exhibits are eligible for both state and district fairs.

The following rules, applicable to both district and state fairs, concern the size and nature of exhibits.

1. Exhibits must be confined to a space 30 in. in depth (front to back) by 4 ft. in width. There is no limitation as to height other than that it must be kept within reasonable bounds.
2. Electric power (110 volts AC) will be available.
3. No gas or running water is guaranteed.
4. Dangerous chemicals, open flames, explosions, poisonous reptiles, and starvation experiments on animals will not be accepted.
5. The local director may refuse permission to exhibit for reasons of safety, sanitation, or the best interests of the fair.
6. All work on exhibits must be that of the students themselves. For possible exceptions see the sections of *Suggestions to Teachers* and *Pointers for Student Exhibitors.*
7. Official entry blanks will be those furnished by the fair director and they must be submitted in accordance with the rules established by the fair director.

SUGGESTIONS TO TEACHERS

In order to have a successful science fair you must have a sufficient number of exhibits. These exhibits represent the culmination of the science project work carried out under the direction of the individual teachers. To have a sufficient number of exhibits you must have available lists of projects suitable to the level of your class, and you must have your students motivated to proceed with their projects with a minimum of effort on your part. They must know where they can obtain information concerning their projects. Sufficient material for exhibits must be available and students must have the means for preparing their exhibits. They must know to whom they may go—local doctors, engineers, chemists, etc.—for help in developing their projects.

The question is often raised as to whether the preparation of a project should be required of all students. This question must be answered by you in the light of your local conditions. In junior high school science classes the requirement of a project by all students works very successfully in many locations. Under these circumstances projects cannot be as complicated as in more advanced classes and in many cases will be simply good poster displays. Having a project prepared by all students will enable you to have a much greater coverage of subject matter and thus will aid you in the instructional program in your class.

For senior high school students, especially those in their last year, the compulsory procedure is questionable. The preparation of an exhibit should be a pleasure and not a chore. Many senior students are so involved in diverse activities that they will not produce a good project. This defeats the purpose of the science fair program. Better no project at all than one of inferior quality.

Projects may be short term affairs or may extend over months and perhaps over a two or three year period. Where long range projects are carried out, deep interest is evident on the part of the student and his work will inspire others to produce good projects. Such long-range projects should be encouraged.

The following suggestions are made for your consideration:

1. Make a list of possible projects.
    a. The Director of the Science Fair Program in North Carolina can supply you with lists of projects from recent district and state fairs.
    b. Write the Science Clubs of America for all material of use in preparing exhibits. Your attention is called specifically to the Science Club Sponsors Handbook and Thousands of Science Projects. Information concerning these publications is given on pages 22, 23, and 24 of this Manual.

c. Place suggestions on 3 x 5 in. cards and file these by subject fields. Keep the file current from year to year.

2. Enlist the aid of the school or area librarian or librarians.
   a. Encourage the keeping of files of periodicals containing scientific information, magazine articles, pictures, etc.
   b. Valuable materials can be obtained from the National Science Teachers Association's Science Teacher Package Service Kits. Keep these on file.
   c. Work out a plan with the librarian for the use of the library in connection with science fair project work.
   d. Encourage students to visit and use local and public libraries.
3. Hold personal interviews with each student concerning his project.
   a. Learn the student's interests, what he wants to do after leaving high school, and whether or not he plans to attend college. Suggest a project or projects related to his interests.
   b. Show the student how the project will help him. Point out that the success of the project is measured by what he learns from it, not whether or not he wins a prize.
   c. Suggest local scientists, doctors, or other individuals in the community who may be willing to help him with his project. Perhaps you will have a committee on sponsors which will help you with this.
   d. Working with your proper fair committee suggest sources from which the student can obtain materials at low cost or free of charge for use in preparing exhibits.
4. Motivate and encourage students to work on projects and to carry them through to completion.
   a. The teacher must be convinced of the worth of the project and must show his enthusiasm.
   b. Allow the student time to work on his project. Assignments should be made shortly after the start of school.
   c. If possible have short reports on projects during class periods, laboratory periods, or at science club meetings.
   d. If feasible give consideration in your grading system to satisfactory project work.
   e. Prevent loafing by keeping the students posted as to the length of time before the fair.
   f. Emphasize the importance of contacts with scientists in the area or any other persons who may be able to help the students with their projects.
   g. Acquaint the students with the critical shortage of scientists and the opportunities in the field of science.

h. Permit students with outstanding exhibits to present them before the class or at a science club meeting.
i. Tell the students that they may get help from any source. However, the actual work should be essentially their own. If an exhibitor borrows a special piece of equipment or has some special work done by his father, as in the preparation of cabinet work, proper acknowledgment must be made in his exhibit.
j. Help the student to understand the criteria that will be used in the judging and evaluation of his exhibit.

5. Organize a science club in your school.
   a. Affiliate with the Science Clubs of America.
   b. Use science club programs as opportunities for students to compare notes on their projects, report on progress, or otherwise talk about their various projects. Have them exchange ideas as to where they may obtain help and how they may obtain needed materials.
   c. Have the science club sponsor the local fair.

Your attention is called to several sets of colored slides showing winning exhibits at various national fairs and at North Carolina state fairs. You will find these most interesting and they will prove of invaluable help in motivating students and helping them prepare their exhibits. They may be obtained from your district director. You will find his name and address on the current Science Fair brochure.

The question is often raised as to how much class time should be given to work on science fair projects. This again will have to be answered on the local level. In junior high school, work on projects can be made a part of the laboratory program in a most effective manner. In the higher level classes, such as those in chemistry and physics, the laboratory work is usually well-organized, and follows a rather tight schedule. The use of laboratory time for project work could, if not handled effectively, cut in on needed laboratory work. On the other hand, many students will get far more from project work than they will from routine experiments. They may complete their routine experiments in a minimum of time and use the time so saved for project work.

The section which follows, *Pointers to Student Exhibitors—Selection of and Preparation of Exhibits,* has been written primarily for the use of the student. It has been prepared in mimeograph form and you may obtain as many copies as you need for distribution to your students by writing the director of the North Carolina Science Fair Program. Mimeographed copies of the section, *Judging—Criteria and Rules,* are also available for distribution.

POINTERS TO STUDENT EXHIBITORS—SELECTION OF AND PREPARATION OF EXHIBITS

The work of preparing an exhibit for a science fair has many of the characteristics of a scientific research project as carried out in a research laboratory in industry or in a university or government laboratory. Let us therefore start this discussion by seeing how a research scientist would proceed with a research problem. In general he would proceed along the following lines:

1. Rather than rushing into the laboratory and starting some ill-planned experiments, he would search the literature and make careful notes of all information pertaining to his problem. In this way he would find out what had been accomplished by other investigators and what progress had been made on similar problems.
2. He would discuss his problem with his associates and any other interested individuals. They may have personal experiences that would be of great help to him.
3. He would work out a tentative plan of procedure. Proper attention would be given to the time available for completing his study.
4. He would then start actual experimental work. Initial experiments would probably be started on a small scale. He would probably use mock-ups of inexpensive equipment. Preliminary laboratory work might indicate the need for further library work. He would keep a record of all data. What at the moment may appear to be useless may later prove of great importance. A CAREFULLY PREPARED WRITTEN RECORD OF ALL WORK AND ALL RESULTS IS KEPT.

Now let us look at some of the steps you will follow and some of the things you must consider in developing your science fair project.

1. *Selection of your project.* Of course you may have a particular project in mind or that you have been working on and that particularly appeals to you. But if you have the problem of selecting a project it is recommended that you consult the lists of projects from recent district, state, and national fairs and the booklet: *Thousands of Science Projects.* Your teacher can get the lists of exhibits from the state director and obtain a copy of the booklet from the Science Clubs of America. Your selection should be tentative and it is well to start with two or more selections.
2. *Select a good exhibit subject.* The subject you select should

tell a story or present a picture of a particular segment or phase of science. It should not be so comprehensive that it cannot be properly presented in your project.

3. *Select a subject that you are interested in.* The purpose of preparing a project is not to win a prize but rather to teach you something about science and scientific methods. You should enjoy preparing your exhibit. A subject that you are not interested in will seldom result in a good exhibit.
4. *Discuss your selection with your teacher.* Your teacher can tell you whether or not your project is suitable for your particular fair. He can give you valuable advice as to where you can obtain information about your project, where you can obtain necessary material, and who may be able to help you. Talk with your teacher from time to time as to your progress with your project.
5. *Talk with your fellow students and any other interested people.* Your fellow students, parents, or local people such as doctors, engineers, and science teachers may be able to give you valuable suggestions. If possible have someone act as your sponsor.
6. *Read all available material pertaining to your project.* Consult your school librarian or any other available librarians. Read up on your project in all books available, in magazine articles, technical papers, etc. Write down all pertinent information.
7. *Plan your project.* Outline a plan of procedure giving proper attention to the time element. Rough out your exhibit on paper. Read the rules pertaining to your fair. Look over the score card to be used in evaluating your project. Be sure your project follows the requirements in connection with the use of dangerous chemicals, open flames, poisonous reptiles, and experiments concerned with animals. If you plan to use electrical power, gas, or water, make sure they are available. Is your plan to use electrical power a safe one? Note the space available for your exhibit. Decide what experimental work you will have to do in preparation for your exhibit. Make overlays, sketch out arrangements, always keeping in mind the size of the objects to be included.
8. *Keep your exhibit simple.* Do not overcrowd an exhibit with too many objects or too many details. Select a few objects and emphasize these with plain backgrounds. Your exhibit is to tell a story. Don't confuse the basic story with too many details.
9. *Consider the question of lighting.* Ordinary lighting may

not bring out the best points in your exhibit. In such cases consider the question of special lighting. Try to conceal the fixtures and arrange them so as to prevent glare. Focus the lights on the points of interest.

10. *Suggest life and action whenever possible.*
11. *Visitor participation is desirable.* Attention is focused on an exhibit if visitors can press a button and see something happen, look through a magnifying glass, guess weights of objects, or do other things that result in action.
12. *Give your exhibit a good, descriptive title.*
13. *Decide on the reading matter to be incorporated with your exhibit.* Use short clearly-lettered legends. Long legends are not read by the average visitor. SPELL CORRECTLY. A record of your work in preparing the exhibit with copies of electrical circuits, optical systems, etc. in the form of a booklet or in the form of charts may add a great deal to your exhibit.
14. *Can you obtain the materials necessary for your exhibit?* As far as possible use locally-obtained materials. Keep a record of your costs. Visit your local lumber yards, department stores, etc. If you have a sponsor who is working closely with you, he may be of great help in this phase of your work. Wall board and corrugated cardboard from large boxes can be used very effectively on many exhibits.
15. *Make your exhibit colorful.* Use color for emphasis. If you have an art instructor in your school, she may be able to give you valuable pointers. A color chart obtained from a local paint store may prove helpful. Organize your color scheme before starting to paint. Avoid glossy finishes.
16. *Is your exhibit easily movable?* Can you assemble your exhibit and take it down easily and without harming your project? Can it be easily packed for shipment?
17. *The exhibit is to be your own work.* In general teachers and other people are to assist you only as advisors. However, this does not mean that you cannot have a special piece of cabinet work made for you, borrow a special piece of equipment, or have some special signs prepared. It means that such should be kept to a minimum and should be used to bring out and emphasize your own work. Be sure to acknowledge such special help in your exhibit.

Now perhaps a few comments about the final preparation of your project for exhibition will be helpful. How will you arrange your exhibit? Will you use sides and a back for your project. Will

you place your project on the floor or plan to arrange it on a table or stand?

Remember that the maximum space allowed in the district, state, and national fairs is a floor or table space four feet from side to side and 30 inches from front to back. There is no restriction as to height, but it should be kept within reasonable bounds. These restrictions may not apply to your local fair.

There are various ways of arranging your exhibit. The picture on the back of this Manual shows a great variety of exhibits and a variety of ways of arranging exhibits. Other pictures are shown in the manual. Your teacher may borrow a set of slides showing exhibits at various fairs. A number of pictures of exhibits are shown in the folder: *Are You in the Science Fair?* Other pictures are shown in the booklet: *Thousands of Science Projects.* Study these pictures carefully. You will see some exhibits similar to yours and you will be able to obtain some excellent ideas as to how to mount and arrange your exhibit.

You will note various methods of arrangement. If your exhibit is a telescope or a similar piece of equipment, or if it is contained in a comparatively tall cabinet or set of component parts, you will probably wish to set it directly on the floor without sides or back to your exhibit area. If your project consists of chemical or physical apparatus, objects under magnifiers or microscopes, models, industrial mock-ups, electrical circuits, or growing plants you will probably wish to display your exhibit on a base board or on the top of a table.

Exhibits on a base board or on top of a table may have side panels and a back. These may be used to hold component parts or for the display of signs or information. The panels and back should be of sturdy material—wallboard, plywood, etc. Peg-board with predrilled holes is excellent and the holes make mounting of material quite easy. The parts should be hinged for purposes of strength and for ease in storing and moving. You may or may not wish to put a top on your exhibit. If you do, proper attention must be paid to lighting problems.

If your exhibit contains expensive equipment or material that should not be handled, you may wish to use a glass front. This introduces viewing problems and should not be used unless necessary.

JUDGING—CRITERIA AND RULES

A science fair could be held just as an exhibition of project work without any emphasis upon competition or any recognition for comparative degree of work. However, a competitive exhibition of project work held under the guidance of teachers and other interested people is considered a more stimulating activity and most certainly serves to emphasize those things which go to make up a good exhibit. Other exhibitors will be stimulated in the handling of future projects and the proper criteria for a good exhibit will, in general, be established for future fair exhibitors. *As far as possible each exhibitor should receive a personal appraisal of his efforts.* Constructive, creative, and imaginative criticism can do much towards encouraging additional work of a sound nature among all participants.

In judging, the fundamental purposes of the science fair program must be kept in mind. Scientific investigation is the purpose of science fair projects. An exhibit is the result of some interest or curiosity, and the project represents a desire on the part of the student to get an answer to a question or problem or to have a better understanding of a scientific principle. Thus, a student has to read about his project, take notes, make observations, talk with qualified people, take a field trip, experiment, design, and build a project, or use any other approach that will prove profitable. When placed before the judges, the project should be examined with the above in mind.

The judges should examine the project with this thought in mind: what question or problem was the student trying to answer or solve, or what important scientific principle was the student trying to explain or illustrate? A simple experiment might show much better work on the part of the exhibitor than a complex piece of equipment which shows little knowledge other than a high degree of mechanical skill. Collections of biological specimens or minerals may very well illustrate and answer a scientific question.

After the judges note what question or problem the exhibitor has tried to answer, they must decide how well the student has answered it. Does the exhibit tell a complete (not necessarily the whole) story? It may tell only a part of the story. Does the exhibit show creative work on the part of the student? Does it show that he has really striven for an answer? Has he arranged his findings in an orderly manner? These aspects are considered in greater detail later in this section.

The general survey of a project as discussed in the preceding

paragraph could be evaluated by answering the following questions. To each might be assigned a value of 100%. High scores on all points should be a prerequisite to a further judging of the exhibit.

1. Does the exhibit give an answer to a question, a solution to a problem, or clarify a scientific principle? ..... points
2. Does the exhibit show creative and original work? ..... points
3. Is the exhibit attractive? ..... points

After the judges have decided on those projects worthy of further consideration, the score card used at the National Fair could well be used. At the district and state fairs it is the card that must be used. The criteria given on this card, the point value of each, and a brief discussion of each follows:

1. *Creative Ability*—30 points
   Does the exhibit show originality of thinking and of illustrating a scientific principle?
2. *Scientific Thought*—30 points
   Does the exhibit show evidence of well organized work, an extensive searching for facts, or the use of controlled experimentation and a careful analysis of data?
3. *Skill*—10 points
   Does the exhibit show good workmanship in the handling of materials?
   Was the exhibit made from raw materials or were the materials purchased?
4. *Thoroughness*—10 points
   Does the exhibit give a complete story of the scientific principle or process involved?
5. *Clarity*—10 points
   Does the exhibit give a picture that the average person can understand?
   Is the exhibit neatly described by guide marks, labels and drawings?
6. *Dramatic Value*—10 points
   How does the overall attractiveness of the exhibit compare with others in the same category? Does it "catch your eye"?

Judging a science fair is a very difficult task and the higher the level of the fair the more difficult it becomes. At the state and national fairs all exhibits are in a sense winners. On the classroom level, the judging can be done by a teacher individually or with the help of other teachers. This may also be done on the school level, but beyond this judges from the community or from nearby

communities should be used. The judges can be selected from professional personnel such as doctors and engineers, teachers from other schools, faculty members of nearby colleges, and scientists from laboratories, industrial concerns, or government agencies.

In a general way, one might list the following qualifications for judges:

1. Good training in either the biological sciences, the earth sciences, the physical sciences, or in specific areas of the larger scientific fields.
2. Acquaintance with the science program of junior and senior high schools (this qualification may prove to be a difficult one).
3. Recognition of good techniques in science teaching.
4. A keen interest in young people.
5. A desire to help improve the science work of the students.

If possible, the judges should be organized into two groups:

1. Several persons trained in biological sciences and a science educator.
2. Several persons trained in the physical or earth sciences and a science educator.

In smaller communities it may be difficult to assemble groups with the above qualifications.

Judges should be selected as early in the year as possible. They should be given a copy of the judging criteria as soon as possible, and a sample of the score card. If possible, the judges should be sent any other pertinent material having to do with science fairs. Copies of this section of the Manual can be furnished by the State Director of Science Fairs if the local director requests them. If it can be arranged, have a meeting of the judges early in the year and by all means have one or more briefing periods, not only to enable you to talk with the judges but to enable the judges to talk among themselves. At that meeting you can emphasize the need for talking with each individual exhibitor as far as this proves possible. Certainly all those whose exhibits are in the running should be interviewed by one or more of the judges.

One of the difficulties in judging is concerned with the proper amount of time for the evaluation of exhibits. The judges are on the whole busy men or women, but it will be found that they are willing to give as much time as is needed provided you give them that time. Keep this important point in mind when handling the problems of judging.

Judges should assemble with all the necessary material for judging. Furnish them with score cards, note paper, and a clip

board to which is tied a pencil with an eraser. After forming into the proper teams, the judges should give a fairly rapid run-down of the exhibits and should check off those not considered worthy of further consideration. The three fundamental criteria given earlier in this section should be used as the criteria for this first selection. The judges should then proceed with the evaluation of the remaining individual exhibits in accordance with the detailed score card. Probably all of the above should be done in the absence of the exhibitors. However, before the final decisions are made, each exhibitor should be allowed to explain his exhibit and should be carefully questioned by one or more of the judges. As far as possible, the judges should each talk with as many exhibitors as possible. It gives the students a lift and may bring out some points missed in the preliminary scoring. It then becomes the duty of the judges to make the final decisions.

Judging should receive as much recognition as possible in the public press and in the fair program. The judges should be made to feel the importance of their work and the extent to which it is appreciated. Excellent judges should be used from year to year, and where such individuals do not care to serve over a period of years they could be consulted in connection with the selection of other judges.

PRIZES AND AWARDS

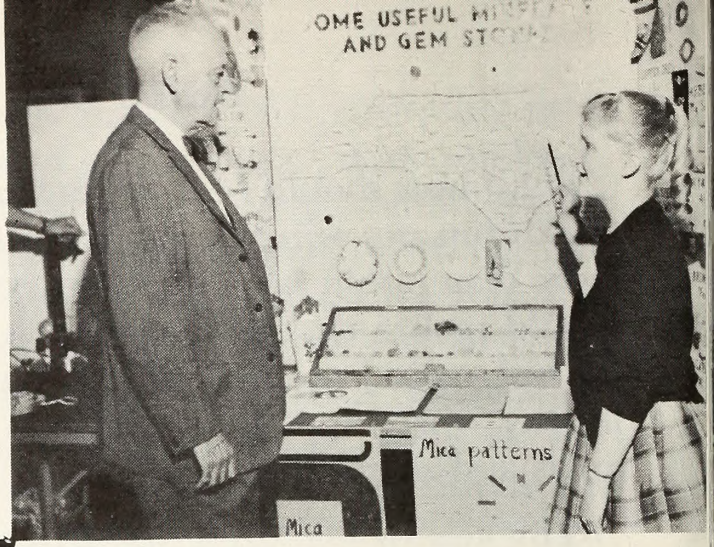
Exhibitors should be made to realize that only a limited number of exhibits can win awards. Many excellent exhibits will get little more than public recognition or perhaps not even that. Exhibitors should realize that their reward is the satisfaction of having performed a good piece of work, what they have learned from their project work, and the satisfaction of competing with other students and sharing their ideas.

The awards that are made at the state fair are listed in the current science fair brochure. The national fair has a long list of awards of various kinds. The awards given at the district fairs are determined by the District Director or a suitable committee. Some local, school, and classroom fairs make no awards while others make extensive awards. Those directing such fairs must decide this question in line with prior experience and the funds available for awards.

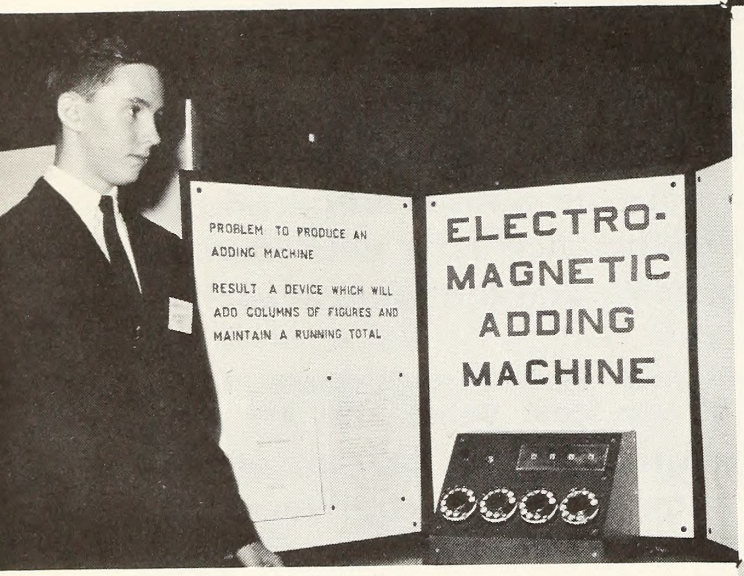
In general, money awards are of the least value and are not recommended. Many of the awards at the National Fair are of the "wish award" type. A winner is allowed to pick equipment or scientific material up to a certain value. This is an excellent type of award. Perhaps books could be offered in place of equipment or supplies. The awards could go to the school rather than to the individual, with a notation and acknowledgement in the book or on the equipment concerning the winner. Subscription to scientific publications make excellent awards and are comparatively inexpensive. In addition to formal prizes the issuing of inexpensive medals, certificates of merit, ribbons, etc. is recommended.

In setting up your system of awards, have as many categories as possible based on the type of exhibit, age of the exhibitor, grade, and category, etc. Give certificates of participation to all entering exhibitors if this is feasible. Give as many first, second, and third place ribbons as possible. They serve as effective awards even when expensive awards cannot be made. Attach seals of merit to as many certificates as rate recognition. All of these minor forms of recognition are appreciated and will stimulate exhibitors to greater effort in succeeding years.

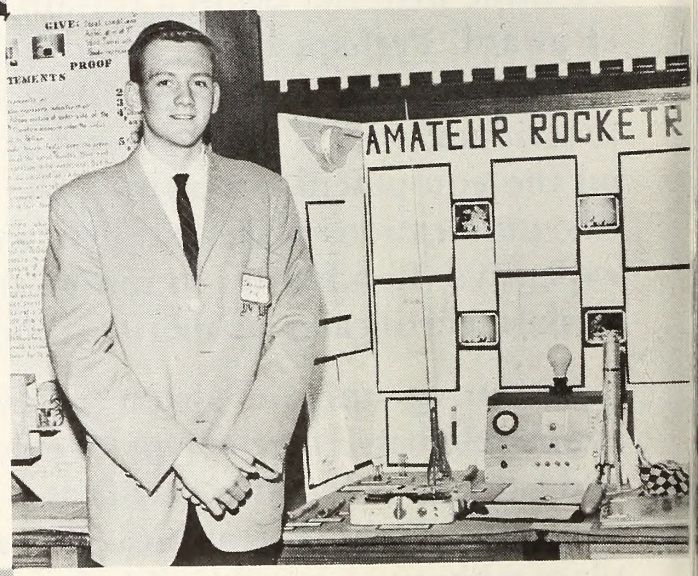
As far as possible recognize the winners, even when the award is only a seal of merit. Mark all the winning exhibits so that they will be known to the public. Have an awards ceremony. Have the names of the winners appear in the school paper and in the local press and post the list of winners on the bulletin boards.



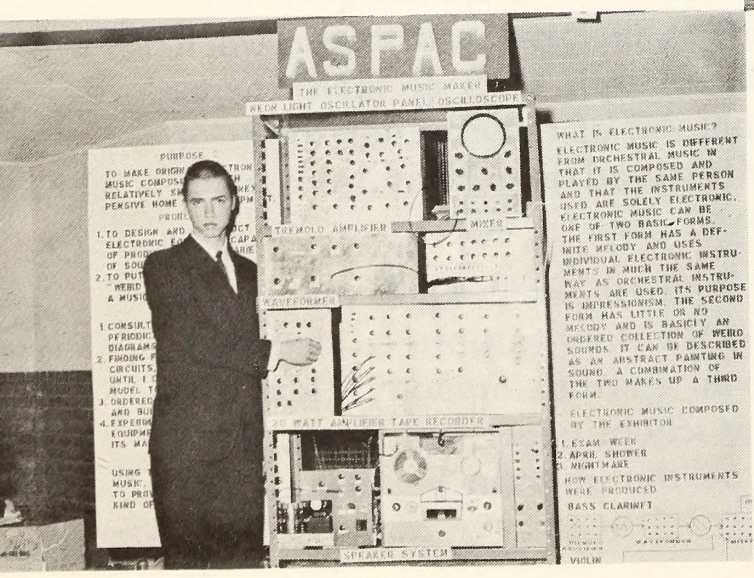
State Science Fair


PROBLEM: TO PRODUCE AN ADDING MACHINE
RESULT: A DEVICE WHICH WILL ADD COLUMNS OF FIGURES AND MAINTAIN A RUNNING TOTAL
ELECTRO-MAGNETIC ADDING MACHINE

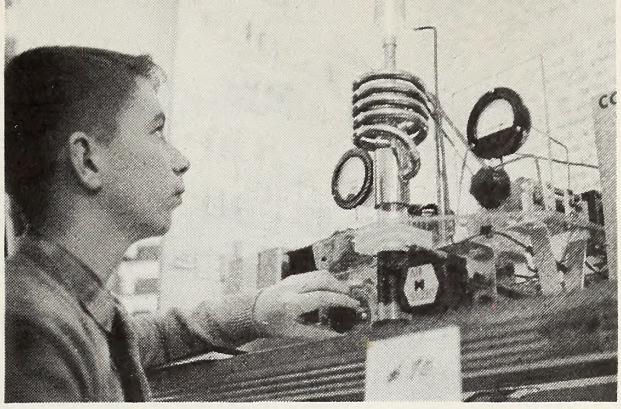
Warren Willis
Sanford Central High
Raleigh District Fair



Noel Dunivant, Jr.
Whiteville High
State Science Fair
First Place Winner, Carolina Power & Light Company Youth Conference on the Atom awards program

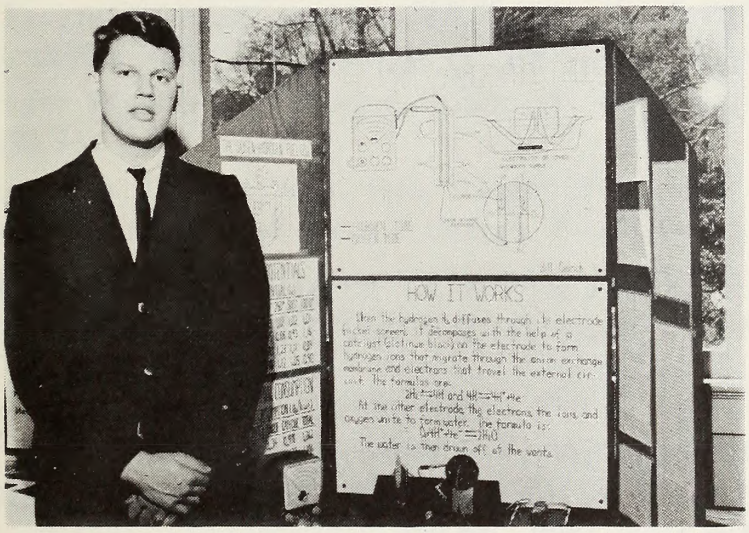

ASPAC
THE ELECTRONIC MUSIC MAKER
ATOM LIGHT OSCILLATOR PANEL OSCILLOSCOPE
TREMOLO AMPLIFIER
MIXER
WAVEFORMER
WHAT IS ELECTRONIC MUSIC?
ELECTRONIC MUSIC IS DIFFERENT FROM ORCHESTRAL MUSIC IN THAT IT IS COMPOSED AND PLAYED BY THE SAME PERSON AND THAT THE INSTRUMENTS USED ARE SOLELY ELECTRONIC. ELECTRONIC MUSIC CAN BE ONE OF TWO BASIC FORMS. THE FIRST FORM HAS A DEFINITE MELODY AND USES INDIVIDUAL ELECTRONIC INSTRUMENTS IN MUCH THE SAME WAY AS ORCHESTRAL INSTRUMENTS ARE USED. ITS PURPOSE IS IMPRESSIONISM. THE SECOND FORM HAS LITTLE OR NO MELODY AND IS BASICLY AN ORDERED COLLECTION OF WEIRD SOUNDS. IT CAN BE DESCRIBED AS AN ABSTRACT PAINTING IN SOUND. A COMBINATION OF THE TWO MAKES UP A THIRD FORM.
ELECTRONIC MUSIC COMPOSED BY THE EXHIBITOR
1. EXAM WEEK
2. APRIL SHOWER
3. NIGHTMARE
HOW ELECTRONIC INSTRUMENTS WERE PRODUCED
BASS CLARINET
VIOLIN
SPEAKER SYSTEM

Hal Chamberlin
Needham Broughton High School
State Science Fair
Second Place Winner, Carolina Power & Light Company Youth Conference on the Atom awards program

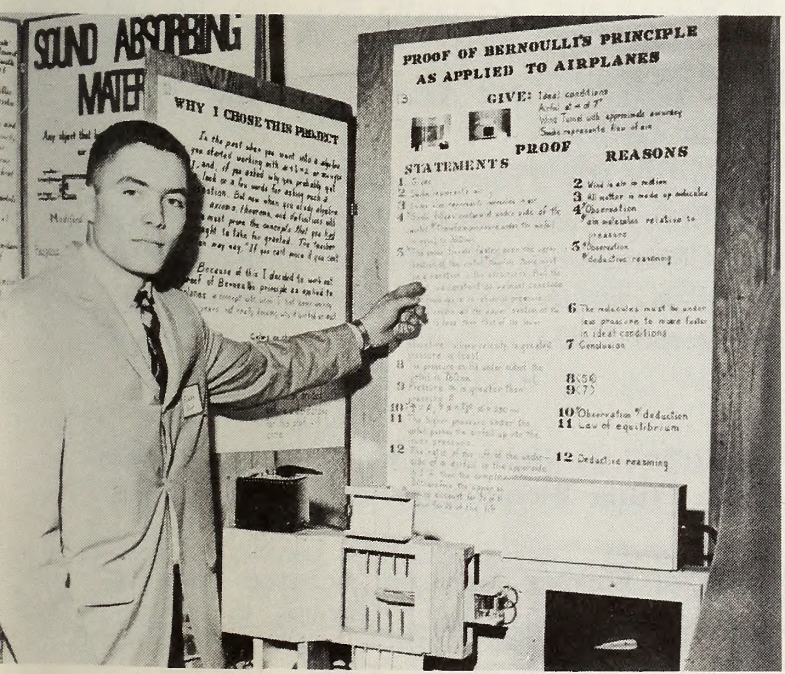


State Science Fair, Raleigh

Richard Long, West Montgomery High
State Science Fair



Bill Oelrich, Sanford Central High
State Science Fair



John H. Flake, Clinton High
State Science Fair

Leo Finkelstein, Asheville
State Science Fair

Sets of colored slides of exhibits from National and State Fairs can be borrowed from your District Director.

The February, 1956, issue of the High School Journal contains a number of articles on the various phases of the science fair program. Your principal or your library may have a copy. You may *borrow* a copy from the State Director of Science Fairs.

Mimeographed lists of exhibits from National and State Fairs can be obtained from the State Director, North Carolina Science Fairs.

The following may be obtained from:

Science Service
1719 N Street, N.W.
Washington 36, D. C.

A SCIENCE FAIR BIBLIOGRAPHY FOR TEACHERS AND STUDENTS

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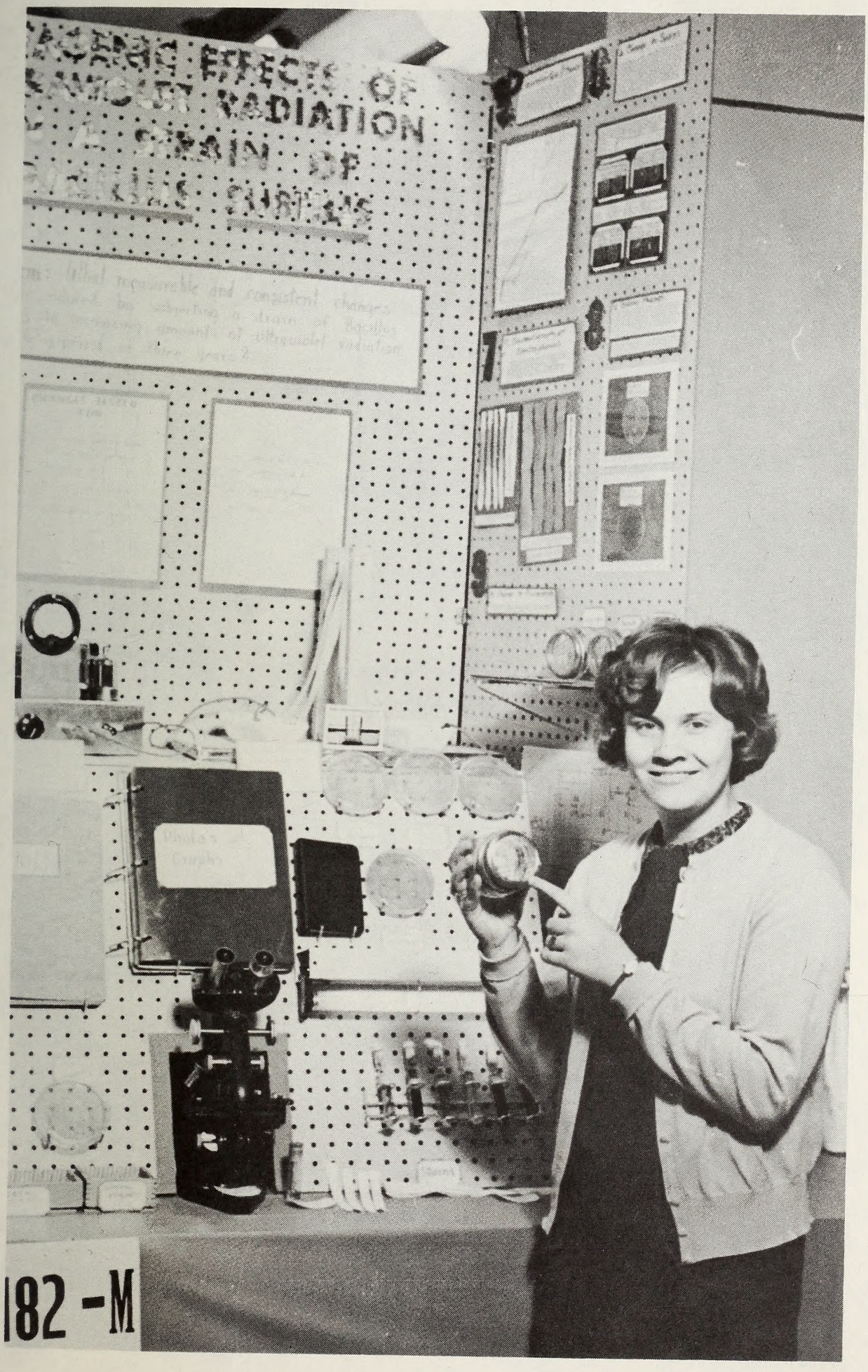
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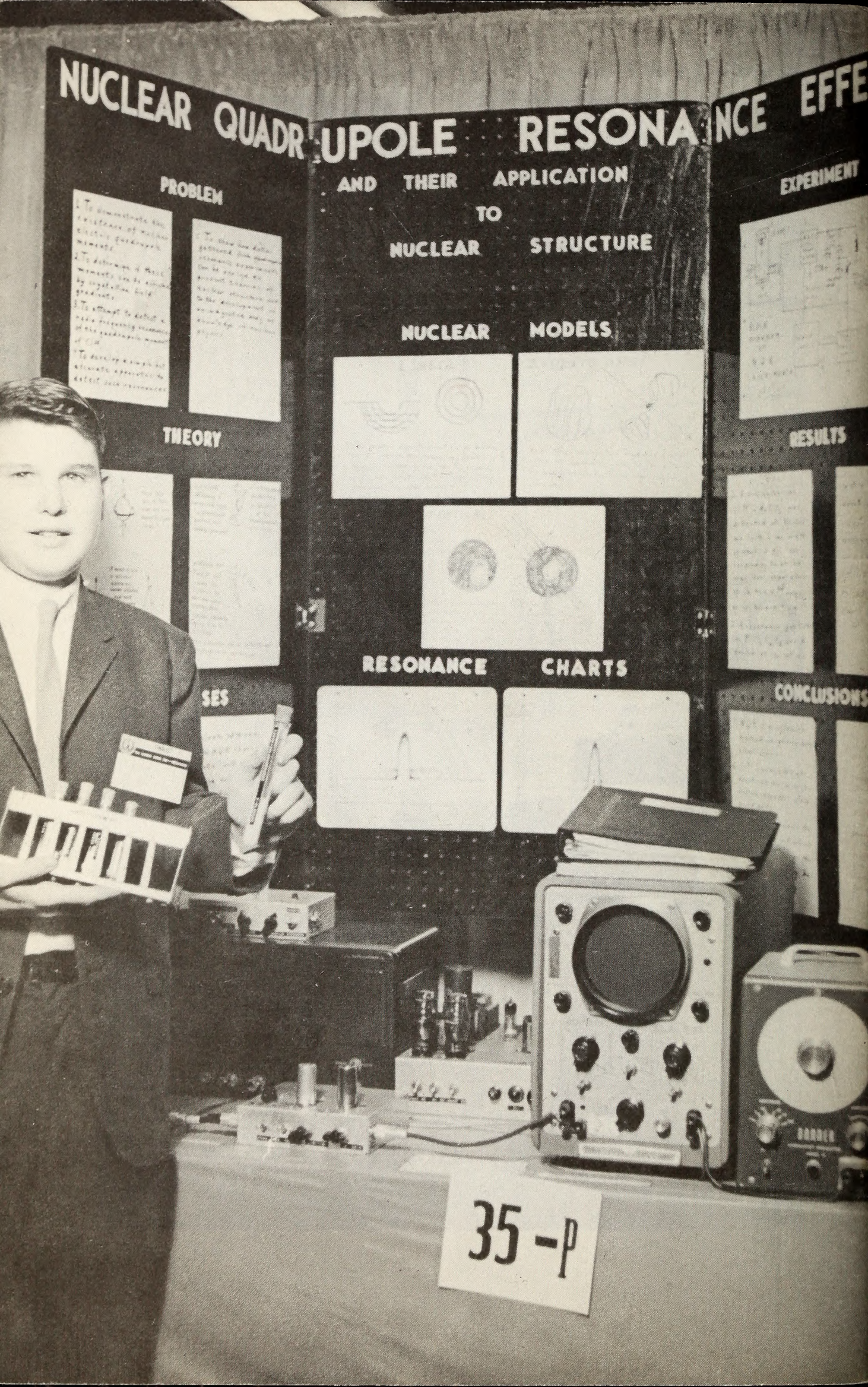
NUCLEAR QUADR
UPOLE RESONA
NCE EFFE
AND THEIR APPLICATION
TO
NUCLEAR STRUCTURE
PROBLEM
EXPERIMENT
THEORY
RESULTS
NUCLEAR MODELS
RESONANCE CHARTS
SES
CONCLUSIONS
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